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मानक

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“Step Out From the Old to the New”

IS 14610 (1999): Automotive vehicles - Fuel consumption on chassis dynamometer - Method of measurement [TED 4: Automotive Braking Systems]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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स्वचल वाहन — चैसिस डायनामोमीटर पर
ईंधन खपत — मापन पद्धति

Indian Standard

AUTOMOTIVE VEHICLES — FUEL
CONSUMPTION ON CHASSIS
DYNAMOMETER — METHOD OF
MEASUREMENT

ICS 43.060.40 ; 19.060

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Vehicle Testing and Performance Evaluation Sectional Committee had been approved by the Transport Engineering Division Council.

The depletion of oil reserves is necessitating us to design and manufacture fuel efficient vehicles which would help in the conservation of energy and also benefit the vehicle users by corresponding savings in fuel costs.

The committee formulating the standard felt the need to standardize the method of measurement of fuel consumption on chassis dynamometer with the Indian driving cycle used for emission measurement. The following Indian Standards deals with the method of measurement fuel consumption on a test track:

IS 10881 : 1994 Automotive vehicles — Mopeds, scooters and motor cycles — Method of measurement of fuel consumption

IS 11921 : 1993 Automotive vehicles — Method of evaluation of fuel consumption (*first revision*)

The present standard and the method outlined in it would aid in evaluating fuel consumption on a chassis dynamometer ensuring the necessary repeatability and reproducibility of the results of tests. This standard is prepared to provide a uniform testing procedure to be followed while testing the vehicles.

Testing procedure for measuring mass emission from vehicles have been covered extensively in IS 14600:1998. The procedure for measuring fuel consumption is similar to emission measurement and hence considerable assistance is taken from the above said standard while preparing this standard. The driving cycle prescribed for mandatory emission tests needs be followed for fuel consumption measurement also.

The Government has already issued instructions to include measurement and recording of fuel consumption under CMVR of:

Two and three wheelers	As per driving cycle
Passenger cars	As per driving cycle and at a constant speed of 50 kmph
Light commercial vehicles fitted with diesel engines	At a constant speed of 50 kmph

For the purpose of the standard for correction factor based on specific gravity the method outlined in SAEJ 1376 July 1982 'Fuel economy measurement test (Engineering type) for trucks and buses' has been utilized. After formulation of a national method the same can be considered for incorporation in this standard.

The composition of the committee responsible for preparation of this standard is given in Annex A.

Indian Standard

AUTOMOTIVE VEHICLES — FUEL CONSUMPTION ON CHASSIS DYNAMOMETER — METHOD OF MEASUREMENT

1 SCOPE

This standard covers the test procedure for measurement of fuel consumption on chassis dynamometer under driving cycle conditions and also at constant speed.

2 REFERENCES

The following Indian Standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
14599 : 1998	Automotive Vehicles — Performance requirements (Measurement of power, SFC, opacity) of positive and compression ignition engines — Method of test
14600 : 1998	Automotive vehicles — Exhaust emissions — Gaseous pollutants from vehicles equipped with internal combustion engines — Method of measurement

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 14600 shall apply.

4 TECHNICAL SPECIFICATIONS OF VEHICLE

4.1 Technical specifications of vehicle as relevant to fuel consumption shall be declared by vehicle manufacturer and shall contain at least the details given in Annex B of IS 14599 for compression ignition engines and Annex C of IS 14600 for spark ignition engines.

NOTE — If the specification submitted for complete type approval of a vehicle contain the details given above, there is no necessity of submitting this information again.

4.2 Modifications/changes in technical specification (in case of statutory testing):

Every functional modification pertaining to technical specifications of vehicle shall be intimated to the testing agency as per 4.1. If the changes to the vehicle do not effect the fuel consumption adversely the results are applicable to the modified vehicle also. Those changes which do not constitute a model change are as follows:

- a) A change in reference mass requiring merely the use of next higher or any lower inertia in Table 4 of IS 14600
- b) If different body configurations are used with the same power plant and driver-line and the change in the load equation due to changes in the coefficient of resistance is less than that would be caused by the change of inertia to one step higher or any lower than the inertia setting in Table 4 of IS 14600
- c) If the overall transmission ratio is changed and when the calculated $E = (V_2 - V_1)/V_1$, where V_1 and V_2 are respectively the vehicle speed corresponding to 1 000 rev/min of the engine of the unmodified and modified vehicle is less than 8 percent.

5 TEST EQUIPMENT

All testing equipments such as chassis dynamometer, emission analyzing equipments, etc, shall be as per the details given in 4.2.6 of IS 14600.

6 TEST PROCEDURE FOR TESTING AS PER DRIVING CYCLE

The vehicle shall be tested for measuring mass emission. During the test the mass emission of carbon monoxide (CO), total hydrocarbons (HC) and carbon dioxide (CO₂) shall be measured as specified in 4.2.7 to 4.2.10 of IS 14600. The fuel consumption shall be calculated from this data by carbon balance method, using the following formula:

$$F_c = 0.866 K + (0.866 \text{ HC} + 0.429 \text{ CO} + 0.273 \text{ CO}_2)$$

where

F_c = fuel consumption in km/l,

K = density of fuel used in g/l,

CO = mass emission of carbon monoxide (g/km),

HC = mass emission of hydrocarbon (g/km), and

CO₂ = mass emission of carbon dioxide (g/km).

NOTE — The test results, even if the test is conducted primarily for establishing the emission performance, can be used for calculating the fuel consumption.

7 FUEL CONSUMPTION TESTS AT CONSTANT SPEED

The procedure shall be same as that of 6, except that instead of driving cycles, the vehicle shall be driven at constant speed on a chassis dynamometer for a distance of not less than 1 000 m. The test shall be conducted to obtain three readings which are within ± 3 percent of the arithmetic average and they shall be reported as the test result.

8 FUEL CONSUMPTION MEASUREMENT BY ALTERNATE METHOD

8.1 Alternatively, instead of using the Carbon Balance Technique as given in 6, the fuel consumption may be established by measuring the actual fuel consumed during the test in such cases.

8.2 Fuel measuring system shall be compatible to the fuel used and its connection and operations shall not hamper the normal functioning of the vehicle. The least count of the measuring equipment shall not be more than 0.1 ml, of volumetric or 0.01 g if gravimetric and the accuracy shall not be more than ± 1 percent of the measured quantity.

8.3 The fuel consumption (F_c) shall be calculated as follows:

$$F_c = S/Q \times C_1 \times C_2 \times C_3$$

where

F_c = fuel consumption in km/l,

S = total distance travelled during the test in metres, and

C_1 = correction for mixing of lubricating oil $1/(1+v/1\ 000)$.

where

v = volume of oil in cc added to one litre of fuel

Q = total volumetric fuel consumption in cc

C_2 = temperature correction for fuel $1 + (T_f - 27)/1\ 000$ (if fuel is measured volumetrically) otherwise 1

T_f = fuel temperature in °C

a) In the case of petrol

C_3 = 1 if reference fuel is used otherwise

C_3 = $1 + 0.8 (0.729 - G_s)$

where

G_s = specific gravity of fuel used at reference temperature of 27°C

b) In case of diesel

C_3 = 1 if reference fuel is used, otherwise

C_3 = $42\ 000/C_v$

where

C_v = calorific value of diesel for testing in kJ/kg

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Automotive Vehicle Testing and Performance Evaluation Sectional Committee, TED 8

Chairman

SHRI R. RAMAKRISHNAN
28, I Cross Road
Kasturi Bai Nagar
Adyar, Chennai 600020.

Members

SHRI R. R. G. MENON
SHRI R. C. BALAKRISHNAN (*Alternate*)
SHRI RAJAT NANDI
SHRI S. G. SHAH (*Alternate*)
SHRI V. K. BHATIA
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SHRI M. L. MEHTA (*Alternate*)
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MAJOR BALWINDER SINGH (*Alternate*)
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SHRI M. K. MISHRA
SHRI R. G. KAREMORE (*Alternate*)
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SHRI A. R. GULATI,
Director (Transport Engg)

Representing

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Association of Indian Automobile Manufacturers, New Delhi

Association of State Road Transport Undertakings, New Delhi

Automotive Research Association of India Ltd, Pune

Bajaj Auto Ltd, Pune

Bajaj Tempo Ltd, Pune

Central Institute of Road Transport, Pune

Central Farm Machine Training and Testing Institute, Budni

Controllerate of Quality Assurance (Vehicles) [DGAQ(V)],
Ministry of Defence, Ahmednagar

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Directorate General of Supplies & Disposals, New Delhi

Department of Industrial Development, New Delhi

Royal Enfield Motors Ltd, Chennai
Escorts Ltd, Faridabad

Hero Honda Motors Ltd, New Delhi

Hindustan Motors Ltd, Hooghly

Indian Institute of Petroleum, Dehra Dun

Kinetic Engg Ltd, Pune
Mahindra & Mahindra Ltd, Mumbai

Maruti Udyog Ltd, Gurgaon

Premier Automobiles Ltd, Mumbai

Standing Committee (Tech & Stores) CIRT, Pune

Swaraj Mazda Ltd, Chandigarh

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Vehicle Research and Development Establishment, Ahmednagar

Vehicle Factory, Jabalpur, Ministry of Defence, Ordnance Factory Board

Volvo India Pvt, Ltd, Bangalore
Director General, BIS (*Ex-officio Member*)

Member-Secretary

SHRI A. K. NAGPAL
Additional Director (Transport Engg), BIS

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	323 76 17, 323 38 41
Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola CALCUTTA 700054	{ 337 84 99, 337 85 61 337 86 26, 337 91 20
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022	{ 60 38 43 60 20 25
Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113	{ 235 02 16, 235 04 42 235 15 19, 235 23 15
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	{ 832 92 95, 832 78 58 832 78 91, 832 78 92
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